

Reducing Waste Water Losses in the Water Utility at Tirgu Mures



Transferable Solution

Project Summary

Project Activities

Project Benefits

Lessons Learned

Contact Information

Project Title: Study for the implementation of a strategic plan to control and reduce drinking water losses in Tirgu Mures, Romania

Leader: Aquaserv, Tirgu Mures, Romania

Partner: Aquacust Water Loss Analysis Co. Ltd., Budapest, Hungary

Location: Tirgu Mures, Romania

Project Duration: September 2000–September 2001

EcoLinks Project Investment: Total EcoLinks Project Investment: \$68,102;
EcoLinks Grant Support: \$49,456; Project Team Cost Share Contribution: \$18,646.

Best Practice: Transferable Solution

This Best Practice established a system for detecting water leaks and reducing and controlling water loss in the municipal water distribution network in Tirgu Mures, Romania. Water companies and municipalities throughout Romania and Eastern Europe can use the same methodology to improve drinking water management including reduced energy and water consumption. This EcoLinks funded project developed an effective, transferable approach to address the problem of drinking water loss including 1) an audit of water loss; 2) a periodical leak detection system and a leak detection team; 3) a feasibility study for an on-line monitoring system, 4) a water loss reduction plan; and 5) a medium term investment plan.

Project Summary

Tirgu Mures is the municipal capital city of Mures County. Its current population is 165,000 inhabitants and is expected to grow to 200,000 by 2010 with the expansion of Mures County that already includes several densely populated villages. The drinking water network for Mures County was originally built around the turn of the 20th century. It has been adjusted over time to meet the needs of the communities of Mures County, but over 50% of the system is 20 years old and many of the pipes are not protected against corrosion. The system needs to be sufficiently monitored and maintained to prevent and reduce water loss. With the support of an EcoLinks Challenge Grant, a collaborative effort between Aquaserv and two Hungarian consulting firms was initiated to create and implement a management system that prevents and reduces water loss.

Aquaserv is responsible for providing drinking water and wastewater services to Mures County. Operating the water distribution network poses several challenges. Water management is difficult because flow measurements are not systematically taken for all supply zones. There are a significant number of pipe bursts, and the leakage rate is high in the network. It is often difficult to locate the source of pipe or valve leaks. Pipe materials, fittings and maintenance are poor. Measurement errors and leaks account for the bulk of all water loss in Mures County in 2000 (1,490,000 m³ per year). This loss costs Aquaserv \$77,257 (8.3% of its annual income). While Aquaserv has repaired the most damaged water pipes and has installed a centralized system for monitoring water pressure within the main pipes, it has yet to establish a systematic, integrated leak detection program and a strategic plan for reducing water loss.

To address the problem of water loss, several actions were taken. First, an assessment of water loss in the water distribution network of Tirgu Mures was conducted targeting three pilot areas. Data on water loss was gathered from these three sites. Using this data and other information sources, an audit report on water loss figures, economic factors associated with water loss, and recommendations for reducing and controlling water loss were prepared. A leak monitoring plan and a water loss reduction strategy were developed.

This project provides several capacity building, environmental, and economic benefits. It builds the organizational capacity to reduce municipal water loss by training key people to detect and manage leaks efficiently. Environmental benefits include a water savings of 490,000 m³ per year. Energy consumption is also notably reduced since less electricity is needed to treat and transport water and wastewater. Multiple economic savings are generated through reductions in costs associated with water and energy consumption, operational costs, and water and wastewater treatment costs.

Project Activities

The thrust of this project was to develop a leak detection system and a strategic plan for reducing and controlling water loss. The specific activities of the project are discussed in detail below.

1. Shared and prepared information on the water supply system

Action: Aquaserv conducted a presentation for project partners on the most important components of the city water supply system including the mains, pumping stations, hydrophore stations, reservoirs and the treatment plant.

Aquaserv prepared 116 map frames (i.e., a “mosaic”) of the water distribution network in Tirgu Mures, including connections, pits, valves, etc. The maps highlighted zones with similar piping structures and problems.

Product(s): 1) Presentation on city water supply system 2) One hundred and sixteen map frames of the Tirgu Mures water distribution network .

2. Conducted an assessment of water loss in three pilot areas

Action: Selected and evaluated three pilot areas to conduct measurements of water flow and identify possible leaks. The following three pilot areas were inspected: Zone in Tudor Vladimirescu, Hydrophore Zone in Tudor Vladimirescu, and Libertatii. Based on the results of the inspections, a work plan was developed.

Equipment to measure leaks including a flow meter, pressure meter, batteries and battery charger, and recording equipment was purchased. In preparation for data gathering, valve repairs and replacements were done, and pits were cleaned. Preliminary measurements were taken in the hydrophore zone in Tudor Vladimirescu after installing a flow meter and a data logger.

Measurements were then taken and recorded for all the pilot areas. For night measurements, the pilot areas were isolated by closing the valves and supplying them with water by making connections through the pit chambers. Night flow measurements were taken for each pilot area. Minimum night flow was determined for the distribution pipes. For day measurements, leakage sites were determined and dealt with on a customer-by-customer basis (Tirgu Mures has an individual metering system).

Product(s): 1) Pilot study focus 2) Work plan 3) Measuring equipment 4) Data on water flow and leaks.

3. Prepared audit report

Action: An audit report was prepared based on multiple data sources (e.g., city documentation, measurements, etc.). The audit report included the results from two measurement periods, an economic analysis of water loss, conclusions and recommendations for reducing and controlling water loss.

Product(s): Audit Report .

4. Initiated monitoring plan for evaluating leak detection methods

Action: A monitoring plan was initiated. It outlines two methods for monitoring leaks: 1) periodical leak detection using a portable minilaboratory for water leak checks every other year, and 2) on-line measurement system to detect leaks immediately. A feasibility study of an on-line leakage monitoring system was conducted and outlined the investment structure necessary to implement this system. The Feasibility Study provides an overview of the water supply and treatment system in Tirgu Mures and the features, costs, and benefits of an on-line leak detection system. Training sessions and the preparation of a manual on periodical leak detection procedures were completed. Aquaserv employees and employees from two other water companies were trained in managing leak issues. The training addressed managing leak information, making decisions regarding pipe breaks and repairs, managing pipe breaks and repairs, costs and benefits of periodical leak detection, and preparing the financial framework associated with decreasing daily consumption per capita. Work procedures for the periodical detection of leaks were established.

Product(s): 1) Feasibility Study, "On-Line Leakage Monitoring System" 2) Publication, "Network analysis and proposal regarding solutions for on-line monitoring of the drinking water distribution system parameters" 3) Software to process and store data from on-line measuring system 4) Trained personnel (including five people from two other water companies) in leak detection: two day training for skilled personnel and three day training for execution personnel 5) Manual on Periodical Leak Detection Procedures 6) Document summary titled, "Necessary Resources for the Carrying Out of the Proposed Leakage Analysis Method" 7) Job descriptions.

5. Developed strategic plan for reducing water loss

Action: Based on the audit results, a strategic plan was drafted. The plan includes an investment strategy, good housekeeping measures, a methodology for conducting a cost/benefit analysis of the process for detecting and reducing water leaks. The results of this plan provide the basis for making decisions on how and when to apply an on-line or periodical leak detection approach.

Project Benefits

There are multiple benefits produced by this project and the implementation of the proposed system. Aquaserv increases its organizational capacity to avoid wasteful water consumption. By reducing water loss, unnecessary pressure on water and energy resources is avoided. Additionally, the costs associated with energy and water consumption are reduced. These benefits are discussed in more detail in the following subsections.

Capacity Building Benefits

Aquaserv is responsible for delivering drinking water to a growing population in Mures County. This project establishes a collaborative network to improve Aquaserv's capacity to serve this community with drinking water. As part of this project, Aquaserv established two contacts in Hungary that provide technical support to address water loss problems. Aquaserv gained international working experience that will make it easier for them to participate in other collaborative projects emphasizing technology transfer.

Local expertise on reducing water loss was strengthened. Aquaserv trained personnel from their own company as well as from two other water companies in water leak detection and monitoring. Managers are being trained to oversee the periodical leak detection system. Aquaserv anticipates formally establishing a leak detection team.

Environmental Benefits

The most significant environmental benefit generated by this project is the reduction in the wasteful consumption of water and electricity. This project provides a method for monitoring drinking water flow so that it goes to the consumer and is not lost through leaks in the distribution network. By reducing water leaks, Aquaserv reduces the amount of unaccounted for water loss by 490,000m³ water per year. The number of leaks in the system shall be reduced by 50% in seven years from 2001. Electricity consumption is also reduced since less energy is required to treat and to transport drinking water from the River Mures, through the network, and to the consumer.

In addition to the more efficient use of water and energy resources, this project promotes certain environmental benefits associated with reductions in pollution. Since less electrical energy is needed to pump water from the river to the consumer and ultimately treat it as effluent, less CO₂ is released into the atmosphere. Additionally, fewer chemical pollutants from the wastewater treatment process are released into the River Mures.

Economic Benefits

By implementing this project, the costs associated with energy and water consumption, pipe and valve repairs, water and wastewater treatment, and operations are reduced. This is especially true over the long-term. The savings generated by the water management system outlined in this project will cover the expenses of implementing the proposed system in 5-10 years. The overall cost of implementing the water saving program is \$456,253.

Energy costs are reduced due to the reduction in water pumped into and through the distribution network. With a reduction in water being pumped into the network, electrical power consumption is reduced. This translates into the following estimated savings:

Table 1. Estimated Savings from reduced water and energy consumption

Energy Cost Savings (each year after 7 th year of project operation)	\$46,499
Savings from Reduction in Linear Pressure Losses (each year after 7 th year of project operation)	\$57,511
Annual Savings from Reduced Amount of Water Pumped into the Water Treatment Plant	\$28,159
Annual Savings from Reduced Water Treatment Costs	\$97,860
Savings from Decrease in Operational Costs	\$398,724
Savings from a Reduction in Needed Repairs (each year after 7 th year of project operation)	\$111,590

While repair costs will initially grow in the first seven years due to increased leak identification, repair costs will start to decrease by the third year due to lower mechanical stress on the pipes and overall network improvement. After the seventh year of operation, an annual savings of \$111,590 is anticipated from the reduction in needed repairs (estimated average cost of each repair is \$221).

Chemical costs associated with water treatment will decline due to the decline in water demand from leaks. Approximately 80% of the drinking water ends up in the sewer and is treated by the wastewater treatment plant. A reduction in water pumped into the network will lead to a reduction in wastewater treatment costs totaling \$55,266 per year after the seventh year of project operation.

Lessons Learned

There are both opportunities and challenges in implementing this project. They are listed below to benefit those interested in implementing similar efforts in their regions.

- Purchasing equipment can take longer than expected due to internal equipment approval and payment procedures.
- Conducting preliminary measurements makes it easier to keep on schedule with regard to pipe and valve reparations.
- Maintaining a complete database facilitates access to data needed for project implementation. Complete and reliable data on the distribution network and water loss are needed to ensure the quality of findings and recommendations for water management.
- Measuring night flow is easier if hydrants can be used to supply water to certain areas.
- Good cooperation between partners can help to avoid major delays in project implementation.

Contact Information

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